

Implementing Mixed Land Use Rooting Jane Jacobs' Concept of Diversity in Urban Sustainability

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Abstract

nowadays, sustainability has become an important issue in any development project, including area development. This happen because the area development requires space, in this case land. As people developing land, it damages the environment. It means there will be less balance between built environment and natural environment. This calls for concern in urban sustainability. One of the ways to restore the balance is to reduce as much land as possible to be built by maximizing the space. This paper will explore the multiple space use in terms of mixed-use development in different level and also assess mixed land use implementation, which include the concept of diversity in urban sustainability

Keywords: *mixed land use; mix-used development urban sustainability; trias toponoma; literature review*

1. Introduction

Cities around the world are subject to increasing levels of environmental impact of the land development. The development of the cities manifested in several problems such as urban sustainability issue and land scarcity. One of the problems that has emerged as a result of modern urban planning and land development, with its strong emphasis on functional separation, is that it tends to reduce the kind of combinations and interactions—physical, social as well as visual—that support urban qualities and vitality. This calls for a considering urban sustainability in implementing the urban planning policy, particularly in area development because it essentially requires space, in this case land.

Urban sustainability requires minimizing the consumption of space and resources, optimizing urban form to facilitate urban flows, protecting both ecosystem and human health, ensuring equal access to resources and services, and maintaining cultural and social diversity and integrity (Wu, 2009). The idea of urban sustainability is that the space occupied by the present generation should not jeopardize the needs of future generation. Whenever an area (or space so-called in this paper) is developed or constructed, it would create certain level of impact for the nature (Brower and Entrop 2010). This calls for intervention in urban policy planning in many aspects, particularly in developing land use policy. Consequently, urban planners need to ensure sustainable space use. Ultimately, a triad approach developed by Entrop and Brouwers (2010) so-called 'Trias Toponoma' since the space use of a building is, nevertheless, a different aspect than the

common consumables energy, materials or water, for which there are renewable sources. This triad contains the following three steps:

1. In case of step 1 new building development takes place within the existing built-up area. Use as little 'fresh' natural space as possible by using the third dimension of buildings. In the city center it is necessary to build higher or deeper structures. Within this first step it is also possible to use the dimension of time by appointing more than one function to a building. This concept will be explained more extensively within the principle of multiple space use.
2. When it is not possible to achieve the necessary building volume in the already developed and built area, then the built up area can be enlarged to the country side of low natural importance. Enlarge the city with a so-called 'green vision', which for recreational functions makes the relatively natural environment part of these new neighborhoods. This represents a kind of cascading of this non-renewable source.
3. The least sustainable option is to extend the built up area in a rather natural. In this case, the construction of buildings could take place extensively or in other words spread buildings over a large surface in such a way that it has little effect on the main natural structures of the area.

The objective of this paper is to explore the first step of Trias Toponoma focusing on the principle of multiple space use. Multiple space use is explained in which space can be used for multiple functions in three different ways: (1) certain spatial functions can be

stacked; for example apartments can be constructed over a shopping mall (location sharing). (2) A function can be shared by different user groups with only minor adaptations; a school can function as an adult education center in the evenings (time sharing). (3) Functions can be mixed; in a residential area specific offices or industries might also be allowed.

Ultimately, this paper will explore about urban sustainability in terms of the first step of trias toponoma. The focus of this paper will be mixed-use development (also called mixed land use) to maximized the multiple space use, how it match with the sustainable urban form; the contribution towards urban sustainability and the drawbacks of it. This paper is organized as follows. The next section will explain the methodology used in this study. Section III explains the literature review of general concept of urban sustainability then converged to focus on the need of diversity and land use. The extended explanation about mixed land use will be presented in section IV. This paper ends with the conclusion of this study and recommendation for further development

2. Methodology

The study about mixed land use in this paper is conducted by a literature study and empirical market research. The literature review start by describing the concept of urban sustainability, then converged to the concept of diversity introduced by Jane Jacobs then focus on mixed land use development. Empirical market research in here means using several case studies from different literature to analyze and reflect on the impact of one particular sustainable technique or measure for buildings and fitting the Triad framework, in this case Trias Toponoma.

3. Concept of Diversity

Concept of urban sustainability

Urban planning as a concept has been around for at least 26 centuries (Stanislawski, 1946), tracked back as far as ancient Greece. Any form of urban planning, such as city planning has come a long way since then, even though the ancient ideas of grid planning of city layout can still be seen until now. For the past several decades, urban planning has been “unmixing” cities by the use of rigid zoning that separates single land uses into differently colored parts of the city plan. Big city such as New York City and Barcelona still keep their grid layout of the cities. The result is a city with less diversity in local areas and more traffic, as well as reduced safety and diminished attractiveness of local streets (Newman 1997). The consequences of this grid layout is the abundant amount of crossing that requires many traffic lights and causing traffic congestion in certain cross point. Therefore, for a sustainable urban

form, mixed uses should be encouraged in cities, and zoning discouraged.

Many concepts are developed to reach urban sustainability, such as smart growth, new urbanism and urban village claimed that they could be the sustainable urban form. However some literature analysis shows that different combinations of these concepts produce a number of distinguished urban forms. Eventually, the study has identified four models of sustainable urban forms of sustainable urban forms [8].

Neotraditional Development

The vision of neotraditional development was to enhance the quality of life but not at the expense of the “next generation”—an idea that is compatible with today’s principles of sustainable development [10]. There are many type of development that is also based on the neotraditional form of development: transit-oriented development (TOD), transit village, urban village, and new urbanism.

Urban Containment

Urban containment emphasizes policies of compactness due to the results of urban sprawl. In United States, people choose to work and live in the suburban. This calls the policy makers to reconsidering the policy. The goals of containment policy vary widely and include preservation of natural land, as well as farmland and resource extraction land, whose economic value will not be able to compete with urban development; cost-efficient construction and use of urban infrastructure; reinvestment in existing urbanized areas that might otherwise be neglected; and the creation of higher-density land use patterns that encourage a mix of uses and patronage of public transit, leading to a more efficient utilization of land in urbanized areas (Pendall, Martin, and Fulton 2004).

Compact City

The distinctive concepts of the compact city are high density and compactness. It proposes mixed land uses like the approaches of new urbanism or neotraditional development. The European Commission’s Green Paper advocates very strongly the “compact city,” assuming that it makes urban areas more environmentally sustainable and improves quality of life (Commission of European Communities 1990). The compact city is being promoted in the United Kingdom and throughout Europe as a component of the strategy formed to tackle the problem of unsustainability. It is proposed that in more compact cities, travel distances are reduced (thus reducing fuel emissions), rural land is saved from development, local facilities are supported, and local areas become more autonomous.

The Eco City

The eco-city is an umbrella metaphor that encompasses a wide range of urban-ecological proposals that aim to achieve urban sustainability. These approaches propose a wide range of environmental, social, and institutional policies that are directed to managing urban spaces to achieve sustainability. The distinctive concepts of the eco-city are greening and passive solar design. In terms of density and other concepts, the eco-city might be conceived as a “formless” city or an eco-amorphous city. Therefore, the concept of eco city emphasizes to green the city in the policy implementation.

5. Jane Jacobs' concept of diversity

There are seven concepts of urban quality identified that relevant to a sustainable urban environment: environmental quality, human health, efficiency, equity, diversity, accessibility and learning. [3]. One of them is diversity, which consists of diversity of actors (communities, cultures, and individual's behavior) and diversity of built and natural landscapes is crucial to urban resilience and flexibility. This approach to urban quality in relation to sustainability focuses more on the ability of the urban environment to cope with the challenges that come with increasing sustainability and environmental change.

Diversity of activity is essential to the sustainability of cities. Jane Jacobs (1961) popularized the diversity dimension, subsequently adopted and widely accepted by many planning approaches, such as new urbanism, smart growth, and sustainable development. The key thesis of her book *The Death and Life of Great American Cities*, the principle of the close-grained mix of uses, buildings and people, she sets forth as follows:

This ubiquitous principle is the need of cities for a most intricate and close-grained diversity of uses that give each other constant mutual support, both economically and socially. The components of this diversity can differ enormously, but they must supplement each other in certain concrete ways (Jacobs, 1961, p.14).

Jane Jacobs is a trenchant and frequently quoted advocate of the virtues of mixed-use development. She defined four ‘indispensable’ conditions for generating ‘exuberant diversity’ in a city's streets and districts, asserting that all four were necessary to create street diversity and that if anyone was missing the potential vitality would be undermined. Her preconditions are:

The district, and indeed as many of its internal parts as possible, must serve more than one primary function; preferably more than two. These must insure the presence of people who go outdoors on different

schedules and are in the place for different purposes, but who are able to use many facilities in common.

Most blocks must be short; that is, streets and opportunities to turn corners must be frequent.

The district must mingle buildings that vary in age and condition, including a good proportion of old ones so that they vary in the economic yield they must produce. This mingling must be fairly close-grained.

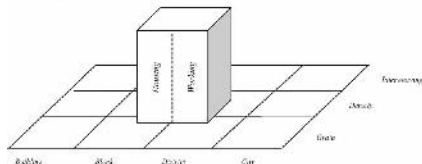
There must be a sufficient dense concentration of people, for whatever purposes they may be there. This includes dense concentration in the case of people who are there because of residence. (Jacobs, 1961) p.151)

According to Jacobs, a balanced mix of working, service and living activities provides a lively, stimulating and secure public realm. Jacobs makes a distinction between mixed primary uses and mixed secondary uses. By primary uses she means residential and major employment or service functions—any land use that generates a large number of people moving through an area (Heppenbrouwer and Louw). These primary uses produce the demand for secondary uses—shops, restaurants, bars and other small-scale facilities. The resulting movements between these uses will occur at different times, forming tidal ebbs and flows. According to Jacobs this leads to a better distribution of demand over the day, adding to local diversity in contrast to a public realm which is occupied by one type of land use which will be used only at certain periods during the day.

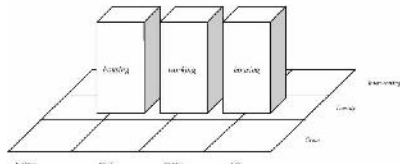
Mixed Land Use

Before proceeding to the definition of the concept, mixed use occurs in different settings. What is the concept of ‘mixed’ in term of ‘mixed-use’ or ‘mixed-used development’ or even ‘mixed land use’? Does the manner in which the different uses are combined, i.e. vertically in a single building or horizontally in multiple buildings on a single site, matter? Putting aside the town-or city-wide level since all towns are mixed at this scale although insufficiently perhaps the other four settings are: (1) within individual buildings; (2) within the street and building blocks; (3) within the districts; and (4) within the city (Rowley, 1996).

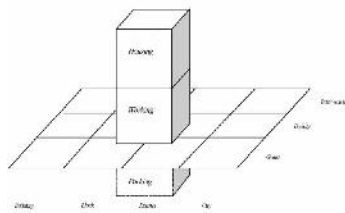
I. Shared premises dimension (point)



II. Horizontal dimension



III. Vertical dimension



IV. Time dimension

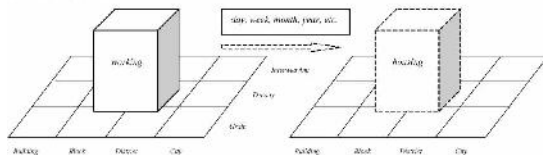


Figure 1. A conceptual model of mixed land use for four dimensions
(Source: Heppenbrouw and Louw)

Besides the scale level, the dimension of the mixed-use development is defined. The dimension component is composed of four elements: (1) the shared premise dimension, (2) the horizontal dimension, (3) the vertical dimension and (4) the time dimension (Heppenbrouwer and Louw). As can be seen in Figure 1, they symbolize mixed-use at a particular point, on a flat surface, vertically clustered and in sequential order. Next to it, urban scale is included, subdivided into building, block, district and city. The relation between the four dimensions and the urban scale is presented in table 1

Table 1. Components of mixed land use: dimensions versus scale
(source: heppernbrou and louw)

	Building	Block	District	City
Shared premises dimension	V			
Horizontal dimension		V	V	V
Vertical dimension	V	V		
Time dimension	V	V		

To avoid the confusion between mixed land use and mixed-use development, this paper will simplify the

level of mixed-use development, by using 3 levels to explore the level of diversity in mixed-use development by using the definition of multiple space usage as explained in the previous section: mixed-use in single building, mixed use in parcel or site and mixed use in an area. Mixed land use in here will refer to the highest level of mixed-use development, which is mixed-use development in an area and mixed use in parcel or site (including street blocks); while multiple space usage in the building will be included in the term mixed-use development.

1. Mixed-use in single building—the mixing of functional use in vertical manner, in this case in within one single building, is where within single building there is multiple function of how space use. Firstly, there can be more than one function within the building in single time. For example, the first two floors of the building are used for offices and shops; and the rest of higher floors are used for residential. Secondly, there can be more than one function within the building in different time. For example, during the day the building is used for kindergarten school and during the night the building can be used for community center where people in the neighborhood gather together.
2. Mixed-use in street or building blocks—the mixing of functional use in horizontal manner that occur within certain street blocks; which is not only one street consists of some building blocks but can also include some street next to it. An example would be the famous Orchard Road in Singapore. There are many different functions of buildings within one big main street of Orchard Road and the smaller streets around it as seen in Figure 2.
3. Mixed-use within walkable or transit area—in this paper, the term mixed land use seems more suitable to define the horizontal diversity in functional use. The mixing of different use should be clearly defined, which is in this paper, mixed land use should occur within walking or transit distance. The proximity of different use is important to consider. An example would be there are various and diverse functions within the neighborhood



Figure 2 . Orchard road building blocks

The entire concept about the need of diversity in the city has developed many concept of what is called 'sustainable city form'. Many kinds of city forms have claimed that the concept of mixed land use is essential. Mixed land use is also a part of the concept of diversity derived from Jacobs. A mixture of uses if it is to be sufficiently complex to sustain city safety, public contact and cross-use, needs a diversity of ingredients (Jacobs, 1961). In this case, the presence of mixed land use should provide the space to accommodate different activities in the city. The different range of functional space would sustain different activities and people presence in the city. This also will create a dynamic for city in terms of different economic, cultural and social context.

To understand the mixed land use concept, we have to understand the characteristic of land use is density. One of the key indicator of urban land use as it affects transport is urban density, particularly the density in the whole city, also in different part of the city such as the CBD (central business district) and inner city (Kenworthy 1996). High densities tend to be associated with lower average trip distances for all modes, improved public transport through higher potential patronage around each stop and in particular, enhanced viability of walking and cycling. Dense, compact urban environments also tend to be more mixed in their land use, rather than heavily zoned and segregated as in low density suburban areas. This further enhances reduced trip lengths and the viability of transit and non-motorized modes. Thus, density is a key factor in the future of cities as regards sustainability.

There are quite some definitions of the concept mixed land use. This can depend either on the context or the scale level of policy. Mixed land use enables a range of land uses including residential, commercial, and industrial to be co-located in an integrated way that supports sustainable forms of transport such as public transport, walking and cycling, and increases neighborhood amenity.

There are some similarities between diversity and mixed land uses; however, diversity is "a multidimensional phenomenon that promotes further desirable urban features, including greater variety of housing types, building densities, household sizes, ages, cultures, and incomes [8]. Thus, diversity represents the social and cultural context of the urban form and mixed land use represent more the functional. The assessment of mixed land use will be explored further in the following section.

6. Assessment Mixed land use

A. Application of Mixed Land Use in different urban form

Over the last decade, mixed land use has been the key role of implementing the concept of new urbanism and used in contemporary planning strategies such as new urbanism. It is a general fact among planners and scholars that mixed land use plays important role in achieving urban sustainability in terms of sustainable urban form. A study shows that the higher level of mixed land use contribute the higher level of sustainability in urban form. The study measure the sustainability in every urban form by scoring the level of mixed land use in every urban form and provides the sustainable urban form matrix, which helps with assessing the sustainability of different urban forms [8]. Apparently, the score of diversity and mixed land use are directly proportional. Whenever, the diversity is high, the mixed land use is also high.

In Neotraditional Development, there are high mixed land use and high diversity level as well. In mixed land uses, it suggests a mix of residential, commercial, and civic uses. Accordingly, the ideal neotraditional town would be self-contained, tightly clustered, walkable, and patterned on the American small town of pre-World War II. It would have mixed land uses, as well as higher densities; street patterns that allow drivers and pedestrians a variety of path options (encouraging people to walk from place to place); distinct traditional architectural characters; and the encouragement of street life through such features as narrower streets, front porches, and public open space [8]. In addition, it provides for mixed land use to create a mix of housing choices and opportunities, provides a variety of friendly transportation modes, and prevents sprawl through a strategy of compactness.

Compact city emphasize also the density and the presence of mixed land use to maximize its compactness. The compact form of compact city can be implemented on a variety of scales, from urban infill to the creation of entirely new settlements. Generally, compactness proposes density of the built environment and intensification of its activities, efficient land planning, diverse and mixed land uses, and efficient transportation systems. Therefore, compact city shows high level of mixed land use and density.

On the other hand, the other two urban forms, urban containment and eco-city, did not show the high level of mixed land use, since the focus of those two urban forms are not the diversity and mixed land use, but the greening and implementation of policy instead. Furthermore, mixed land use is not the only the key that contribute to the urban sustainability but indeed it give contribution in terms of living up the city.

B. The Great Objectives

Some new concept in urban planning like Smart growth of Smart Growth promoted by the Smart

Growth Network established under the auspices of the U.S. Environmental Protection Agency supports mixed land uses as a critical component of achieving better places to live. They claimed that by putting residential, commercial and recreational uses in close proximity to one another, alternatives to driving, such as walking or biking, become viable. The more activities happening in the city, the more people come and go which means the higher the density. The higher the density means the lower proximity to one another, which results in the lower automobile dependence. A study case in some big cities in the United State, Europe and wealthy Asian cities (i.e. Kuala Lumpur, Manila, Jakarta, Surabaya and Singapore) demonstrates significant statistical relationships between the key transport and land use variables: urban density is a key explanatory variable in auto and transit use as well as the relative role of transit (auto use increasing and transit decreasing with decreasing density) (Kenworthy). Mixed land use reduces the probability of using a car for commuting, shopping, and leisure trips, since jobs, shops, and leisure facilities are located nearby. Therefore, mixed-use or heterogeneous zoning allows compatible land uses to locate in close proximity to one another and thereby decrease the travel distances between activities (Parker 1994). People dependence of using their automobile has been major cause of the environmental impact, which has been the main concern of urban sustainability. A study offers a series of directions for land use and transport in cities if the goal of increased urban sustainability is to be met. It suggests that the concept of sustainability is becoming a key global guiding or unifying principle under which to take action to reduce auto dependence in cities. One of the specific sustainability goals is land use objectives (more transit-oriented, higher density, mixed land uses which help to halt the growth in auto-based development) (Kenworthy and Laube, 1996).

Mixed land uses also provide a more diverse and sizable population and commercial base for supporting viable public transit. Mixed use can enhance the vitality and perceived security of an area by increasing the number and activity of people on the street. It attracts pedestrians and helps revitalize community life by making streets, public spaces and pedestrian-oriented retail become places where people meet. The mixture of workplaces and residences generally assures that there are always people around keeping the streets safe with their presence. This also makes people are willing to 'live' the city during the day and night. The "eyes on the street" is one of the several phrases that Jacobs coined and entered into the terminology of urban planning. The presence of people in the city almost all time makes the city relatively safe, since they will feel secure by the eyes on the street.

Mixed land uses can contribute economic benefits. The higher density and diversity means various activities will happen in the city. One of the most important functions to be considered important in mixed-use development is commercial use. This caused by the objectives of developing mixed-use area is to generate more job opportunities by providing different function in certain area. For example, siting commercial areas close to residential areas can raise property values, helping increase local tax receipts. Meanwhile, businesses recognize the benefits associated with locations that attract more people, increasing economic activity.

A study case held in Portland, United States, showed that mixing certain types of land uses with single family residential housing has the effect of increasing residential property values (Song and Knaap, 2004). This is especially true for houses that are closer to public parks or are located in neighborhoods with a relatively large amount of land devoted to public parks. Housing prices also increase when they are close to neighborhood-scale commercial uses, or are part of a community with a relatively large amount of neighborhood-scale commercial uses. In other words, a house tends to be sold at a higher price if it is closer to a public park or a neighborhood store.

Mixed use is implemented in some policy planning because it brings many benefits in economic, social and environmental aspects. The mixing of functional use within the building or the city brings diversity. Consequently, there are many activities fill the city to make people feel safe and secure to do their activities, which give social benefit. On the other hands, mixed land use also created higher density, which brings more economic and environmental benefit in terms of the low level of automobile dependence.

C. Drawbacks

Besides all the advantages, the concept of 'mixed land use', however, is not without ambiguity. Urban planning in the United States has confined 'mixed land use' primarily to particular site developments in the form of 'mega structures'. In various European countries, on the other hand, there has been a trend to promote 'mixed land use' at an urban-wide scale under the banner of the 'compact city', and also in the context of regional development.

Empirical research regarding the relationship between mixed land uses and travel behavior has been limited by the relative complexity of measurement, requirements for parcel or area-level data, and the difficulty in accurately translating findings into public policy [2]. Consequently, it can be assumed that mixed-land use is just an ambiguous concept with many different perceptions. First, ambiguity is an essential

characteristic of core concepts that move between 'theory' and 'practice' in innovative settings. Ambiguity contributes to a concept's 'interpretative viability' and its potential to be mobilized in different directions. Second, 'practical obstacles' are part and parcel of any process of innovation. Third, one should be careful with presenting an image of the 'genuine article'. Concepts evolve and may thus become detached from original settings and ambitions (Legendijk, 2001).

However, existing mixed-use property is perceived to have a number of significant drawbacks as an investment. These include: (1) the sites are often in secondary locations or worse; (2) the schemes are too small; (3) they are tenanted by small businesses who are not regarded as good covenants; (4) multiple tenancies involve higher management costs; (5) mixed-use buildings are regarded as less flexible than single-use ones; (6) residential space imposes constraints on what can be done at a future date which, in turn, inhibits the capital growth of the investment; and (7) there is no proven development mechanism providing a track record for this type of development [6].

Some disadvantages also occurred in terms of housing values. Even though a study shows that housing value increases in mixed land use areas, the results only apply to the house that has closer proximity to commercial use area. However, closer proximity to other function showed lower housing value. The research by Reference (Song and Knaap) revealed, for example, that proximity to multi-family residential units can depress the prices of nearby single-family housing. This finding could be interpreted as bad news for advocates of higher density developments, which is a key element of smart growth strategies, as well as a troubling sign for advocates of low and moderate income housing. The research also revealed that single family homes were adversely affected by dwelling unit density, but not by population density. This is, in fact, quite contradictory to the concept of mixed land use that promoted the higher density (Song and Knaap). Even though the higher density means more sustainable, consumer, however, still values homogenous neighborhood. This calls for a further framework for better implementation of mixed land use in urban planning policy, since the concept of mixed land use still brings ambiguity.

D. Stakeholders Involvement

In every area or urban development project, there must be some actors who might affect and get affected by the change of policy or the project. The adaptation of a new policy approach always involves alignment with the events, interests and agendas of local actors. The interesting point is how local perspectives change as a result of working with a new concept, and how new concepts and coalitions emerge. In the case of mixed-use

development, there are some stakeholders that might be interested in such implementation such as: residential occupier, investor and planner.

The diversity of functional use in a single building or in a site results in many different occupiers, the residential occupier and the non-residential occupier. The residential occupier in here is the tenant of the residential building. The non-residential occupier could be the investor and developer of the non-residential function use of the building (e.g. commercial use) and the employee. Those actors have different interest in the development. Since the mixed land use development affected the housing value in terms of the price of the house and also the possibility of noise nuisance that might occur.

Developers and investors desire maximum value, at minimum risk and at maximum convenience to themselves. Traditionally, they have been preoccupied with the 'exchange value' of development. The complexity and risks of property development has increased towards specializations. This happens not only with the residential occupier but also within the commercial sector. Property developers are criticized for their tendency to 'short-termism' and 'single-mindedness' (Rowley, 1996). Considering the drawbacks of the existing mixed-use property, developers and investor became less interested in mixed use property due to its inflexibility, management cost and different lease length between residential and business occupiers. In short, properties within the mixed land use area are perceived by investor to be less attractive than single-use ones and as a result attract a higher yield and realize a lower exchange value (Rowley 1996). In this case, developers and investors interest is quite high and could affect highly on the value of the property in the mixed land use area.

On the other hand, the concept of mixed land use helps to bring together actors with quite different interests, such as engineers involved in infrastructure and environmental experts concerned with protecting green space. Another case of mixed land use in Atlanta, United States, shows that there are more parties that are interested in implementation of mixed use. That greater potential for impact resulted in the need to involve a multitude of stakeholders in the entitlement process of developing the new Atlantic Station in Atlanta (Herndon, 2011). The process included numerous rounds of public hearings, discussions with neighborhood and community groups, meetings with city and state officials, and continuous negotiations aimed at balancing the concerns of the variety of stakeholders; a list of which included the City of Atlanta Planning Department, the Atlanta Development Authority, the Atlanta Regional Commission, the Georgia Department of Transportation, the

Environmental Protection Agency, the Georgia Institute of Technology, nine neighborhood organizations, and several other business and community groups, including the Midtown Alliance. In this case the stakeholders involved are: local citizen, municipality (or government), planning and transportation authority, environmentalist, academician and business investor (Herndon 2011).

Mixed-use development in area level involved a range of stakeholders. They differ by their interests and power of authority. In single building mixed-use development, the range of stakeholders involved might be relatively smaller than implementing mixed land use in area development.

7. Conclusion

The thinking of urban sustainability has long been considered in urban planning to reduce the environmental impact caused by urban development. Some framework like Trias Toponoma is developed to define a method to reduce environmental impact in term of land use policy. The idea of multiple space usage, which in this paper is defined as 'mixed-use development', is to reduce the usage of space as much as possible by maximizing the usage of existing space (or land), either it is within a single building (vertical manner) or within a district (horizontal manner). The concept of any mixed-use development (i.e. mixed land use) has been implemented in many urban planning policies. The root of this concept began from the concept of diversity in the city. The mixture of different elements lives up the city and generates many activities and ultimately creates the continuous presence of people. Therefore, people will feel safer and more secure to live in the city and it gives social impact for people.

The concept of mixed land use has been proven, in some cases, reduce the travel distance and make closer proximity from A to B. Consequently, it reduces the automobile dependence of the citizen. Ultimately, the amount of car used decreased and lessen the CO₂ emission. The less emission of CO₂ means less major environmental impact. On the other hand, economic impact also occurs due to the less use of car and the increase of people using public transportation. Besides, in term of economic impact, the housing value also increases due to close proximity to various building function (e.g. commercial area, medical center, etc.). In essence, mixed land use give benefit in terms of economic, social and environmental aspects.

Besides all the benefit of mixed land-use, the concept of it seems still brings ambiguity. Firstly because there is no clear boundary of implementing mixed land use. The manner of different use and the dimension should also take into account. Secondly, it

gives inflexibility to the investor who wants to invest in the area. Thirdly, even though various stakeholders have been involved in the development, there is still no clear role of the stakeholders in the project that developing mixed land use. Finally, the concept of mixed land use needs to be reconsidered.

8. Recommendations

Since there are quite some debates in the concept in mixed land use, it is wise to revise land-use priorities to create compact, diverse, green, safe, pleasant and vital mixed-use communities near transit nodes and other transportation facilities [4]. Before proceeding to implementation stage, the type of mixed land uses needs to be compatible with the surrounding single-family residences. The diversity in the city is not necessary to be physical diversity, sometimes the biodiversity in the land use often been ignored. Therefore, public parks should be always welcome.

In terms of commercial sector, new businesses in neighborhoods should be service-oriented and commercial developments should be appropriate to the neighborhood, scaled in size to fit the neighborhood, and should offer convenient access to pedestrians. In this case, before implementing mixed land use in urban planning, urban planners need to set scale and boundary. It can be by utilizing the typology presented in this paper. Therefore, mixing land uses is not smart enough. Real smart sustainable area developments should involve careful selection in how land uses are mixed and assure that such mixing does not detract from the premium still associated with neighborhoods dominated by single family use.

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